

**REMARKS**

Applicant submits this Amendment in response to the Office Action dated July 20, 2010. Reconsideration of the subject application as amended herein is respectfully requested, based on the Request for Continued Examination filed concurrently herewith.

Claims 29-54 were pending in this case; of these, claims 29 and 41 were independent. In the final Office Action, the Examiner rejected claims 29-54 on various statutory grounds. Specifically, all of the claims were rejected under 35 U.S.C. §103(a) as unpatentable over US5932086 (Kasaaian) in view of US3301777 (Leonard). In addition, claims 29-54 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

In this amendment, applicant has canceled claims 29--54, and is presenting herewith new, rewritten claims 55-78, of which claims 55 and 66 are independent. Although new independent claims 55 and 66 correspond generally to cancelled independent claims 29 and 41, respectively, they have been rewritten for greater clarity. Moreover, the rewritten claims do not incorporate any limitation directed to the absence

of a sintering or roasting pre-treatment step (as did cancelled claims 29 and 41); thus, the rejection under 35 U.S.C. §112, first paragraph, relating to the inclusion of that phrase in the claims, has been rendered moot.

Furthermore, and as described in further detail below, the rewritten claims contain new limitations which serve to distinguish them from the cited prior art references, as discussed with the Examiner during an interview held with applicant's representative on September 15, 2010 concerning this case; the Examiner is thanked for the courtesies extended during that interview. As stated in the Examiner's written Interview Summary mailed September 17, 2010, although the claims and the prior art were discussed during that interview, no agreement was reached. Nevertheless, the Examiner discussed with applicant's representative "the addition of limitations from the specification directed to the use of low grade manganese dioxide," and the Examiner "suggested a showing about how the concentration of the dithionate is controlled, if at all, and suggested putting that into the claims." Applicant has implemented the Examiner's suggestions.

First, independent claims 55 and 66 include the limitation that the manganese dioxide containing feedstock being processed has less than 40% manganese (*i.e.*, it is a

"low grade" manganese ore). Although this limitation did not previously appear in the independent claims, it did appear in dependent claims 33 and 45, which have now been cancelled. In connection with this limitation, the Examiner requested during the interview mentioned above that applicant provide an explanation as to why the claimed process works for low grade feedstocks but not for high grade feedstocks, and accordingly, how such a limitation serves to distinguish the claims from Kassaaian.

It is clear from applicant's specification that "low grade" manganese ores are generally those ores that contain primarily manganese dioxide. Thus, when the claims refer to "a manganese dioxide containing feedstock" they are already referring, by definition, to a low grade ore. Nevertheless, the new limitation, that the manganese dioxide containing feedstock being processed contains less than 40% manganese, has been added so as to clarify this even further. In response to the Examiner's specific inquiry, while the process of the present invention may "work" even with manganese dioxide containing feedstocks that comprising more than 40% manganese (*i.e.*, with "high grade" ores), the pyrometallurgical process of the prior art is a much more economical method of processing high grade ores, such as those that are disclosed as the starting material in Kassaaian. By contrast, the present invention allows a hydrometallurgical route for processing low grade ores/feedstocks, which is a more

economical route for the processing of such ores, since the latter are not otherwise economical to process using the roast-reduction (pyrometallurgical) acid leach process of the prior art.

The second limitation that has been introduced into rewritten independent claims 55 and 66 relates to the manner in which the dithionate ion concentration is controlled during the leach step; as mentioned above, the Examiner also addressed this point during the interview with applicant's representative. In the present invention, the dithionate ion concentration is controlled by maintaining an excess of manganese dioxide over sulphur dioxide in the leach solution, and by maintaining the ORP of the leach solution at a level of at least about 550 mV (as compared with an Ag/AgCl reference electrode). These limitations did not previously appear in the claims, and support for them may be found in the specification at page 4, lines 1-5 (as they relate to the invention claimed in independent claim 55) and page 5, lines 5-9 (as they relate to the invention claimed in independent claim 66).

As one skilled in the art will recognize, the hydrometallurgical leaching of solid manganese dioxide, using gaseous sulphur dioxide, is greatly enhanced if a solution-based redox couple is involved in the leaching mechanism, because it is difficult for a

gas to react with a solid when they come into contact. The leaching mechanism in most cases involves  $\text{Fe}^{2+}/\text{Fe}^{3+}$  being present in adequate quantities in the leach solution. To ensure that the reaction kinetics are suitably fast, a soluble iron concentration of greater than 4g/l is preferable, as disclosed in the specification.

Thus, during the course of the leaching of manganese dioxide, the  $\text{Fe}^{3+}$  in solution is first thought to be reduced by gaseous  $\text{SO}_2$  to form  $\text{Fe}^{2+}$ . This  $\text{Fe}^{2+}$  in solution then comes into contact with the solid manganese dioxide and is rapidly re-oxidized back to  $\text{Fe}^{3+}$ , while the  $\text{Mn}^{4+}$  is reduced to  $\text{Mn}^{2+}$  as the manganese dioxide is dissolved. Accordingly, while there is no real net change in measurable  $\text{Fe}^{3+}$  levels, the  $\text{Fe}^{2+}/\text{Fe}^{3+}$  couple has in fact catalyzed the reduction of the manganese dioxide, and some sulphur dioxide gas has been consumed.

Maintaining an excess of manganese dioxide over sulphur dioxide in the leach solution helps to maintain a high ratio of  $\text{Fe}^{3+}$  to  $\text{Fe}^{2+}$  in that solution, which, in turn, causes a high ORP (>550 mV) also to be maintained. The inventor theorizes that this high ORP, combined with the excess of manganese dioxide over sulphur dioxide in the leach solution, promotes the oxidation of sulphur, thus maximizing the formation of sulphate ions (in which sulphur is found in the +6 valence state) as opposed to

dithionate ions (in which sulphur is found in the +5 valence state). Consequently, the formation of dithionate ions is inhibited.

Thus, given the equilibrium between sulphate ions and dithionate ions that is normally found in the leach solution, the inventor found a way to force this equilibrium towards the sulphate side, even though that solution already has a high background of sulphate ions, and even though conventional wisdom would tend to suggest that in such a solution the formation of more sulphate ions (from the oxidation of added sulphur dioxide gas) would be inhibited. Further, while conventional wisdom would also tend to suggest that the reductive leaching of a metal ion is promoted by the presence of an excess of the leachant in the leach solution, in this case it was found not only that *limiting* the amount of the sulphur dioxide gas (the leachant) to sub-stoichiometric levels still results in a quantitative dissolution of manganese from the manganese ore, but also that limiting the amount of sulphur dioxide in the leach solution results in an excess of manganese dioxide over sulphur dioxide in that solution, which also leads (as set forth above) to a higher ORP level; the maintenance of both a higher ORP level and an excess of manganese dioxide inhibits the formation of dithionate ions by favoring the formation of sulphate ions instead.

These mechanisms for minimizing the formation of dithionate ions in the leach solution were not understood in, and are neither disclosed nor suggested by, the prior art, either by the primary Kasaaian reference, or by the secondary Leonard reference, or by those references when taken together, in combination. Accordingly, the rejection under 35 U.S.C. §103(a) has also now been rendered moot, and applicant submits that new independent claims 55 and 66, and *a fortiori* all of the dependent claims, are allowable as now presented.

It is submitted that no new matter has been introduced, and that no additional filing fees are necessitated by the new claims added herein, since neither the number of independent claims, nor the overall total number of claims, exceeds the highest number for which payment was made upon the initial filing of this case. Nevertheless, the Commissioner is authorized to charge any additional claims fees which may be required to the Deposit Account of undersigned counsel, No. 07-1730.

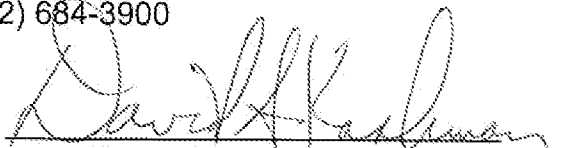
The required retroactive petition for a one-month extension of time in which to file a response to the outstanding Office Action has been submitted in conjunction with the Request for Continued Examination submitted concurrently herewith, and the official fee of \$65.00 as prescribed for that extension by 37 C.F.R. §1.17(a)(1), as amended, in the

case of a small entity, has also been submitted, along with the official fee of \$405.00 associated, also in the case of a small entity, with the Request for Continued Examination itself. The accompanying Request for Continued Examination also authorizes the Commissioner to charge any additional extension fees which may be required, or to credit any overpayment, to the Deposit Account of undersigned counsel.

Applicant has responded herein to the points raised by the Examiner in the Office Action, and applicant has amended the claims in an earnest effort to place this application in condition for allowance. Accordingly, further favorable action in connection with this patent application is earnestly solicited. The Examiner is invited to contact the undersigned attorney by telephone if it will advance the prosecution of this case.

Respectfully submitted,

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